TITAN II LAUNCH VEHICLE

Lockheed Martin Space Systems Company

The NOAA-M satellite will be launched from the Western Range at Vandenberg Air Force Base, California, by a Titan II space launch vehicle (SLV). The Titan II SLV consists of a Titan II intercontinental ballistic missile that has been converted to an SLV configuration through the extensive use of technology and hardware developed during the Titan III and IV programs. It is capable of placing 5,000 lbs (2,268 kg) into a polar low-Earth orbit.

The Titan II SLV is 34.75 m (114 ft) tall and 3.05 m (10 ft) in diameter. Its trisector payload fairing is 6.1 m (20 ft) long and 3.05 m (10 ft) in diameter. A 1.392-m (54.8-in) diameter conical adapter fitting fastens the NOAA-M spacecraft to the launch vehicle. The fairing attached to the forward face of the launch vehicle protects the spacecraft during flight. The Titan II SLV is a two-stage liquid-fueled vehicle. Each stage employs a hypergolic fuel — "Aerozine 50" (50 percent hydrazine, 50 percent unsymmetrical dimethylhydrazine [UDMH]) and a nitrogen tetroxide oxidizer which are pressurized with dry nitrogen.

In-flight guidance is provided by an on-board inertial guidance system (IGS) that is also used on the Titan IV launch vehicle. The IGS is located on a structural truss between the fuel and oxidizer tanks on Stage II. The IGS consists of an Inertial Measurement Unit (IMU) that contains a gimbaled platform with three integrating gyro accelerometers and a missile guidance computer (MGC), which is a random access, thin film core memory, parallel, binary, digital computer. The IGS is an integral part of the SLV's flight control system. The flight control sys-

TITAN II SLV Engine Data (Vacuum)

	Stage 1	Stage 2
No. of Engines	2	1
Thrust per engine (lb)	474,000	100,000
Thrust per engine (N)	2,108,352	448,000
Thrust duration from lift-off (sec)	150	326

tem consists of software in the MGC, a Stage I attitude rate gyro, and hydraulic actuators to gimbal the Stage I and II engine nozzles.

The NOAA-M launch and orbit insertion sequence starts at T-3.2 seconds with a thrust buildup period following Stage I engine ignition. After 3.2 seconds, hold-down bolts are fired and the SLV lifts off. After clearing the launch pad, the SLV rolls to its desired flight azimuth, then begins to pitch over in the trajectory plane. At approximately 150 seconds after lift-off, a commanded shutdown occurs based upon control logic that uses the open loop pitch rate for a time-to-go calculation. The control logic then provides a signal that ignites the Stage II engine and fires separation nuts to separate Stage I. The payload fairing is jettisoned at approximately T+224 seconds, followed by an IGS-initiated Stage II shutdown at approximately T+326 seconds. The spacecraft then separates from stage II approximately 65 seconds after Stage II shutdown, once the required attitude and attitude rates have been met.

APOGEE KICK MOTOR (AKM)

ATK Tactical Systems Company

ATK Tactical Systems Company's (formerly Thiokol Corporation) Star 37XFP AKM solid rocket motor is used to circularize the orbit after spacecraft separation. This 94-cm (37-in) spherical rocket motor provides an average 42.38kN (9,455 lbs) of thrust during a motor burn time of 51 seconds. The Star 37XFP motor, which is attached to the NOAA-M spacecraft, remains with the spacecraft after burnout.

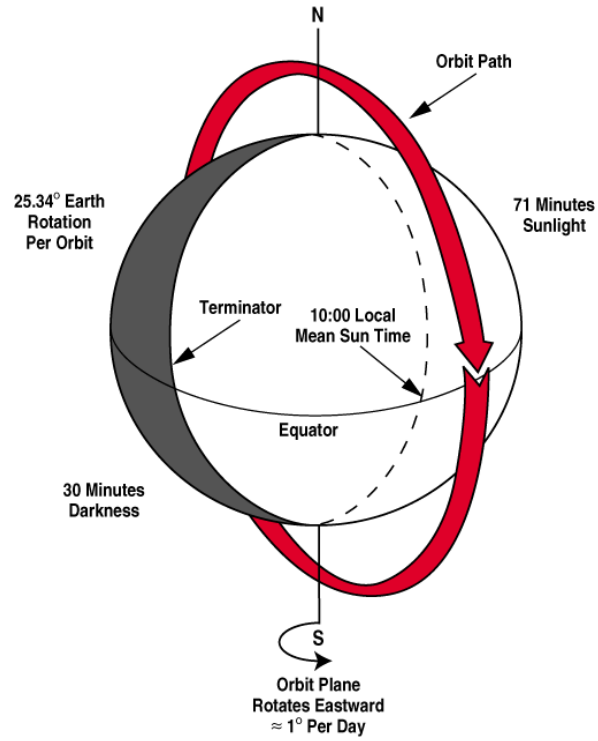
NOAA-M ORBIT

NOAA-M is a three-axis stabilized spacecraft that will be launched into an 833-km (450-nmi) circular, near-polar orbit with an inclination angle of 98.7° (retrograde) to the Equator.

The total orbital period will be approximately 101.35 minutes. The sunlight period will average about 71 minutes, and the Earth shadow period will average about 30 minutes. Because the Earth rotates 25.34° during each NOAA-M orbit, the satellite observes a different portion of the Earth's surface during each orbit.

The nominal orbit is planned to be Sun-synchronous and precesses (rotates) eastward about the Earth's polar axis 0.986° per day (the same rate and direction as the Earth's average daily rotation about the Sun). The precession keeps the satellite in a constant position with reference to the Sun for consistent illumination throughout the year.

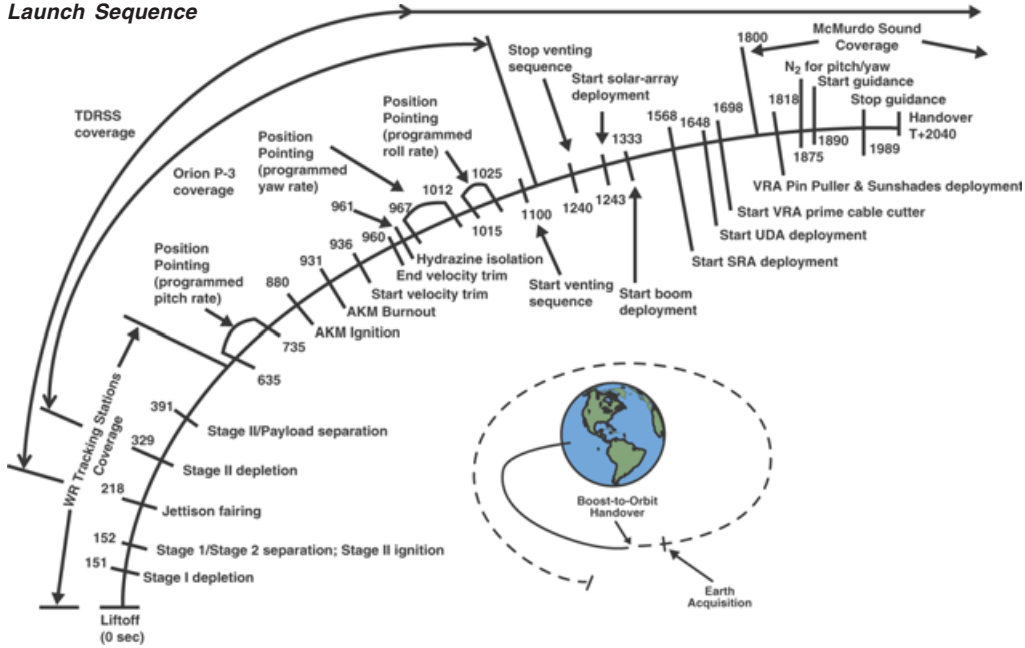
NOAA-M will be launched at 11:22 a.m. Pacific Daylight Time (PDT). The spacecraft will be launched so that it will cross the Equator at about 10 p.m. northbound and 10 a.m. southbound local solar time.



ORBITAL CHARACTERISTICS

Apogee	833 km (450 nmi)
Perigee	833 km (450 nmi)
Minutes per orbit	101.35
Degrees inclination	98.7465

Orbit Launch Sequence



NOAA-M Major Launch Events	
Event	Time From Lift-off (seconds)
Lift-off	0.0
Stage 1 Depletion	150.5
Stage I/Stage II Separation	151.5
Jettison Fairing	218.0
Stage II/Payload Separation	391.0
Pitch Rate - Start	635.0
Pitch Rate - Stop	735.0
AKM Ignition	880.0
AKM Burnout	931.0
Start Velocity Trim	936.0
End Velocity Trim	960.0
Start Venting Sequence	1100.0
Stop Venting Sequence	1240.0
Solar Array Deployment	1243.0
Boom Deployment	1333.0
SRA Deployment	1568.0
UDA Deployment	1648.0
VRA Prime Cable Cutter	1698.0
VRA Pin Puller	1818.0
Sunshades Deployment	1818.5
N2 for Pitch/Yaw	1875.0
Start Guidance	1890.0
Stop Guidance	1989.0
Handover	2040.0